

## ASSESSMENT OF GENETIC VARIABILITY OF SOME NEWLY DEVELOPED WHITERUST RESISTANT LINES OF INDIAN MUSTARD (B.JUNCEA L.)

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### ABSTRACT

108 white rust resistant lines of *Brassica juncea* derived from *Brassica napus* and *Brassica carinata* evaluated with three checks viz. NRCDR02, Rohini, and NRCHB101 for 19 characters through PCV, GCV, heritability, correlation and path analysis. Length of secondary branch had highest PCV and GCV followed by number of secondary branch, number of pod on secondary branch. Number of secondary branch showed highest heritability followed by plant height and first effective branch. Number of secondary branch showed highest GAM followed by length of secondary branch. Plant height, number of primary and secondary branches per plant, length of main shoot, primary branches and secondary branches, number of siliqua on main shoot, primary branch and secondary branch, number of seed per pod, 1000-seed weight, biological yield per plant, harvest index and days to maturity presented positive and significant correlation with seed yield per plant at both phenotypic and genotypic level. Path analysis revealed that number of seed per siliqua had highest positive direct effect on seed yield per plant followed by siliqua on main shoot, siliqua on primary branch, siliqua on secondary branch, pod angle and 1000-seed weight also had positive direct effect on seed yield per plant.

**KEYWORDS:** *Brassica Juncea*, Siliqua, Primary branches and Secondary Branches

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### INTRODUCTION

India is one of the largest rapeseed-mustard growing countries in the world, occupying the first position in Area and second position in Production after China. There are much of need diversity present in germplasm of Indian mustard for different yield and yield contributing traits but there is no diversity present for disease resistant in Indian mustard. A crop is faced many biotic and abiotic stresses in its season duration. All of them, one of the biotic stress is White rust caused by *Albugo candida* reduces the yield up to 60 % in the favorable and late sown condition. All the released high yielding varieties are susceptible to white rust. Hence, the present investigation is carried out to assess the nature and magnitude of genetic variability, their inter-relationships and contribution towards seed yield to generate high yielding recombinants with resistant for the development of high yielding cultivar in Indian mustard adapted to late sown condition for the benefit of farmers.

### MATERIAL AND METHOD

Experimental material comprised of 108 white rust resistant lines and three checks namely NRCDR02, Rohini and NRCHB101. All the lines showed in Augmented Block Design at Directorate of Rapeseed-mustard Research, Bharatpur

during Rabi season of 2010-11. Each line sowed in five rows and row to row spacing is 30cm and plant to plant spacing is 10cm and all agronomic practices applied for the better performance. At the time of maturity randomly selected five plants from each line for recording of data. Data were recorded for 19 characters (Plant height, first effective branch, number of primary branch, number of secondary branch, length of main shoot, length of primary branch, length of secondary branch, silique on main shoot, silique on primary branch, silique on secondary branch, pod length, pod angle, number of seed per pod, 1000-seed weight, oil content, seed yield per plant, biological yield per plant, harvest index and days to maturity). These data were used for statistical analysis. Genotypic and phenotypic correlation coefficients were computed as suggested by Al-Jibouriet *al.* (1958) and path coefficient were worked out as Dewey and Lu (1957).

## RESULTS AND DISCUSSIONS

Analysis of variance revealed significant for most of the characters under study except number of primary branch, silique length, and number of seed per silique, 1000-seed weight, and biological yield per plant and harvest index indicating presence of wide spectrum variability (table 1). The view of the data in table 2 depicted, Estimates of Genotypic coefficient variation varied from oil content (1.42) to length of secondary branch and phenotypic coefficient variation showed similar trend for the respective traits. Maximum and minimum differences between GCV and PCV were observed for 1000-seed weight and plant height indicating the influence of environment for these characters, respectively. Heritability was maximum for plant height and length of secondary branch (0.97) followed by first effective branch and length of primary branch. GCV along with heritability estimate gave the precise picture of genetic gain to be exploited through selection as suggested by Burton (1952). High values of GCV coupled with heritability were observed for length of secondary branch and number of secondary branch suggesting that additive gene action might play major role in the expression these characters and selection would be rewarding in further improvement of these characters (Mahmood et al., 2003; Pant and Singh, 2001; Khulbe et al., 2000; Shalini et al., 2000 and Ghosh and Ghulati, 2001). A parameter having high heritability and high genetic advance are considered under control of additive genes which highlighted the usefulness of selection based on phenotypic performance. (Goshak and Ghulati, 2001; Khulbe et al., 2000; Chaudhary et al., 1999 and kakroo et al, 2000) genetic advance as % of mean was maximum for number of secondary branch (44.09) followed by length of secondary branch (38.48), number of silique on secondary branch (33.45), seed yield per plant (27.10). While a parameter having high  $h^2$  but low G.A. is considered under control non-additive genes. High values genetic advance for number of secondary branch (44.90) and length of secondary branch (38.48) depicted that mass selection based on these parameters could be useful in improving the seed yield from 38.48 to 44.90.

Correlation coefficient analysis (table 3) revealed that number of silique on primary branch had strong positive correlation with seed yield (0.59) followed by number of silique on main shoot (0.55), 1000-seed weight (0.56), length of primary branch (0.48), length of secondary branch (0.46), number of silique on secondary branch (0.45), plant height (0.40), number of seed per silique, biological yield per plant (0.38), length of main shoot (0.37), number of secondary branch (0.26), days to maturity (0.22), harvest index (0.20) and number of primary branch (0.18) (Bikram singh, 2004, Sirohi et al., 2004, Sudan et al., 2004, Kardam and singh, 2005, Sharad and Basudeosingh, 2005 and Tusar et al., 2006). Similarly silique length (0.15) and oil content (0.00) showed positive and non-significant correlation with seed yield per plant and first effective branch (-0.11) and silique angle (-0.01) showed negative and non-significant correlation with seed yield.

## CONCLUSIONS

Path coefficient analysis (table 4) revealed that number of seed per silique had maximum direct effect (0.51) on seed yield. This is not supported by any other character through indirect effect. Character 1000-seed weight (0.45) was second best in its direct effect and this is not supported by any other characters. Trait silique on main shoot had positive direct effect (0.42) and also supported by silique on primary branch through indirectly. Character silique on primary branch had positive direct effect (0.27) this is supported by silique on main shoot. Silique on secondary branch had positive direct effect (0.16) on seed yield and this is supported by silique on main shoot and silique on primary branch. Character silique angle had direct effect (0.12) on seed yield and not supported by any other character. Character main shoot length, secondary branch length and biological yield per plant had negative direct effect on seed yield per plant but these characters showed positive correlation with seed yield per plant due to supported by other characters (poonam and Singh, 2004; Kardam and Singh, 2005; Bikram singh, 2004; and Tusar et al., 2005;). First effective branch and days to maturity had negative direct effect on seed yield. Plant height, number of primary branch, number of secondary branch length of primary branch, length of secondary branch directly increase the seed yield in Indian mustard. A parameter which had high range of genetic variability, high heritability, high genetic advance, highest degree of positive and significant correlation coefficient and highest direct effect on seed yield would be very effective and excellent tool for improving seed yield potential. Such a parameter in this study was number of silique on secondary branch which could raise the seed yield potential up to 33.45 % followed by length of secondary branch. It is concluded that selection of plants on the basis of number of silique on secondary branch and length of secondary branch would raise the potential of seed yield from 1.24 to 44.90 %.

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## APPENDICES

**Table 1: Analysis of Variance for 19 Yield and Yield Component Traits of White Rust Resistant Line in (B.Juncea) Indian Mustard**

source of variation	D F	1 plant height	2First effective branch	3number of primary branch	4number of secondary branch	5length of main shoot	6length of primary branch	7length of secondary branch	8numbr of pod on main shoot	9numbr of pod on primary branch	10number of pod on secondary branch	11pod length	12pod angle	13number of seed pr pod	14test weight	15oil content	16seed yield per plant	17Biological yield per plant	18harvest index	19Days to maturity
Among entries	110	297.45**	240.21**	1.22	9.01**	49.78**	36.13**	90.60**	43.75**	30.62**	16.31**	0.31	13.64*	2.32	0.39	0.14*	1.43*	1.21	48.53	15.04*
Among checks	1	518.96	1042.65*	22.83*	164.08*	149.59*	63.69**	18.5*	421.76*	515.21*	210.9*	5.15*	11.51	19.02*	2.90*	1.13*	24.22*	45.37*	246.27*	11.10**
Among varieties	107	235.33**	226.77**	0.79	4.1**	47.91**	34.37**	67.53**	31.85**	20.31**	11.11**	0.16	13.00*	1.74	0.29	0.12*	0.36*	0.81	44.69	11.96**
Checks v/s varieties	1	6695.61*	0.01	5.13**	223.66*	49.72*	176.10*	4.20	161.02*	184.92*	181.9*	7.55*	119.58*	30.34*	6.76*	0.89*	5.63**	65.75*	63.99	25.78*
Error	15	6.58	9.6*	0.19	0.99	10.40	3.50	2.47	6.94	4.9*	2.62	0.46	4.54	1.72	0.60	0.06	0.38	2.09	31.58	1.66
Genotypic variance	$V_g$	290.9	240	0.73	8.01	39.4	32.9	87.5	36.8	15.7	13.7	0.1	9.61	1.6	0.2	0.28	1.05	0.11	16.9	10.1
Phenotypic variance	$V_p$	297.5	249	1.23	9.01	49.8	36.2	90	43.8	30.6	16.3	0.31	13.9	2.32	0.4	0.34	1.43	1.21	48.5	12.1
Error variance	$V_e$	6.577	9.6*	0.19	0.99	10.4	3.3	2.47	6.94	4.9*	2.62	0.46	4.54	1.72	0.6	0.06	0.38	2.09	31.6	1.66

**Table: 2. Mean, Range of Phenotypic Variability, GCV, PCV, Heritability, Genetic Advance And Genetic Advance As % of Mean in White Rust Resistant Lines of B.Juncea**

Character	MEAN	Range	PCV	GCV	$h^2$	GA	GAM
1 plant height	204.27	168.8 - 264.7	8.54	8.44	97.789	34.74	17.008
2First effective branch	68.11	28.5 -105	23.62	23.18	96.13104	31.26	11.442
3number of primary branch	5.42	3.25 - 8.55	24.19	20.44	59.8479	1.36	22.007
4number of secondary branch	6.89	2.6 - 17	45.86	43.54	89.03921	5.51	44.909
5length of main shoot	67.83	46.8 - 85	11.44	10.40	79.10112	11.50	6.085
6length of primary branch	46.29	33.4 -64	13.58	13.00	90.87623	11.26	9.704
7length of secondary branch	15.93	5.7 - 31.13	60.38	59.57	97.25783	19.01	38.489
8numbr of pod on main shoot	43.12	31 - 56.8	16.51	15.34	84.13437	11.46	9.964
9numbr of pod on primary branch	29.89	17.8 - 43.75	19.96	18.52	83.81696	9.56	13.090
10number of pod on secondary branch	10.01	3.7 - 24.25	43.48	40.36	83.93398	6.98	33.454
11pod length	3.68	2.94 - 4.75	24.00	15.27	-47.223	-0.55	-15.809
12pod angle	24.03	15 - 33.5	17.79	15.54	68.91443	5.30	10.670
13number of seed pr pod	13.48	10 - 24.8	14.91	11.30	25.96093	0.82	4.263

**Table 2 Contd.,**

14test weight	4.66	3.6 - 5.7	21.41	13.55	-49.65007	-0.65	-13.875
15oil content	41.20	39.34 - 42.3	1.54	1.42	82.61722	1.00	3.041
16seed yield per plant	5.73	2.33 - 6.55	23.52	20.88	73.16295	1.80	27.109
17Biological yield per plant	13.57	10.8 - 20.05	15.39	11.10	7.870835	0.24	1.246
18harvest index	42.22	19.4 - 47.35	21.20	16.50	34.92182	5.01	3.97
19Days to maturity	137.45	128 - 146	2.69	2.53	86.24493	6.17	2.33

**Table 3: Genotypic Correlation between Yield and Yield Component Traits in Indian Mustard (*Brassica Juncea*)**

Characters	1 plant height	2First effective branch	3number of primary branch	4number of secondary branch	5Length of main shoot	6length of primary branch	7length of secondary branch	8number of pod on main shoot	9number of pod on primary branch	10number of pod on secondary branch	11pod length	12pod angle	13number of seed per pod	14test weight	15oil content	16seed yield per plant	17Biological yield per plant	18harvest index	19Days to maturity
1	1																		
2	0.33**	1																	
3	0.46**	-0.07	1																
4	0.17*	-0.23**	0.45**	1.00															
5	0.28**	-0.30**	-0.05	0.11	1.00														
6	0.45**	-0.28**	0.11**	0.14	0.62**	1.00													
7	0.40**	-0.38**	0.36**	0.10	0.47**	0.66**	1.00												
8	0.36**	-0.13	0.15	0.19	0.76**	0.52**	0.39**	1.00											
9	0.42**	-0.17*	0.29**	0.29	0.55**	0.73**	0.51**	0.81**	1.00										
10	0.37**	-0.33**	0.27**	0.16	0.42**	0.62**	0.66**	0.40**	0.56**	1.00									
11	0.10	-0.01	0.12	-0.01	0.11	0.00	0.09	0.11	0.04	0.07	1.00								
12	-0.06	0.20*	0.04	0.22**	-0.11	-0.25**	-0.08	-0.09	-0.12	-0.12	0.24**	1.00							
13	0.07	0.00	0.02	0.08	-0.09	0.00	0.12	-0.25**	-0.16	-0.26**	0.32**	0.01	1.00						
14	0.13	0.04	0.03	0.05	0.00	0.11	0.09	0.08	0.03	0.08	-0.01	-0.09	0.09	1.00					
15	-0.02	-0.08	0.00	-0.03	0.02	0.04	-0.01	-0.08	0.00	-0.02	-0.20*	-0.35**	0.01	-0.03	1.00				
16	0.40**	-0.11	0.18*	0.26**	0.37**	0.48**	0.46**	0.55**	0.59**	0.45**	0.15	-0.01	0.40**	0.56**	0.00	1.00			
17	0.27**	-0.05	0.16*	0.17*	0.14	0.14	0.28**	0.26**	0.30**	0.22**	0.09	0.07	0.16	0.26**	-0.09	0.38**	1.00		
18	0.32**	-0.10	0.11	0.20*	0.35**	0.47**	0.38**	0.48**	0.50**	0.39**	0.12	-0.05	0.36**	0.49**	0.03	0.20**	-0.01	1.00	
19	0.10	0.09	-0.01	-0.09	-0.07	-0.10	-0.20	-0.09	-0.15	-0.18*	0.05	-0.09	0.09	-0.07	-0.05	-0.10	-0.16*	-0.03	1.00



**Table 4: Path Coefficient Analysis for 18 Characters Towards Seed Yield Per Plant in B.Juncea**

Charac ters	Pla nt heig ht	First effect ive	Num ber of prim ary bran ch	Numb er of second ary bran ch	Mains hoot length	Prim ary bran ch lent h	Secon dary bran ch length	Siliq ua on MS	Siliq ua on PB	f siliqua on Secon dary Branch	Siliq ua leng th	Siliq ua angl e	Num ber of seed per siliqua	100 0- seed wei ght	Oil cont ent	Biolog ical yield per plant	Harv est inde x	DM
1	0.098	0.022	0.039	0.002	-0.027	0.013	-0.0250	0.1476	0.1114	0.0564	-0.0045	-0.0099	0.0394	0.0630	-0.0006	-0.0177	0.0163	0.0007
2	0.032	-0.069	0.005	-0.004	0.030	-0.007	0.0230	-0.0436	-0.0438	0.0499	-0.0001	0.0242	0.0098	0.0245	-0.0038	0.0018	0.0040	-0.0008
3	0.046	0.004	0.083	0.010	0.003	0.007	-0.0244	0.0828	0.0882	0.0508	-0.0047	0.0016	0.0262	0.0160	0.0001	-0.0119	0.0011	0.0001
4	0.012	0.012	0.038	0.023	-0.015	0.003	-0.0235	0.1102	0.0912	0.0421	0.0003	0.0239	0.0651	0.0258	-0.0013	-0.0120	0.0295	0.0005
5	0.026	0.020	0.002	0.003	-0.105	0.017	-0.0308	0.2808	0.1526	0.0744	-0.0044	0.0150	0.0347	0.0033	0.0010	-0.0095	0.0084	0.0005
6	0.046	0.019	0.021	0.002	-0.064	0.028	-0.0418	0.2184	0.1613	0.1002	-0.0003	0.0326	0.0035	0.0544	0.0028	-0.0096	0.0105	0.0010
7	0.038	0.024	0.031	0.008	-0.050	0.018	-0.0639	0.1804	0.1436	0.1327	-0.0037	0.0114	0.0728	0.0424	-0.0003	-0.0181	0.0089	0.0016
8	0.033	0.007	0.016	0.006	-0.068	0.014	-0.0269	0.4287	0.2227	0.0745	-0.0038	0.0129	0.1028	0.0418	-0.0035	-0.0175	0.0113	0.0007
9	0.040	0.011	0.027	0.007	-0.059	0.017	-0.0339	0.3527	0.2708	0.0975	-0.0014	0.0135	0.0631	0.0145	-0.0001	-0.0197	0.0084	0.0012
10	0.033	0.020	-0.025	0.005	-0.046	0.017	-0.050	0.1898	0.1570	0.1682	-0.0028	0.0160	0.0071	0.0413	-0.0009	-0.0147	0.0182	0.0013
11	0.011	-0.000	-0.010	-0.000	-0.011	0.000	-0.0061	0.0419	0.0096	0.0122	-0.0387	0.0297	0.1693	0.0279	-0.0103	-0.0062	-0.0030	-0.0004
12	-0.007	-0.013	-0.001	0.004	0.012	-0.007	0.0058	-0.0439	-0.0289	0.0213	-0.0091	0.1264	0.0011	-0.0436	-0.0071	-0.0034	0.0014	0.0007
13	-0.007	-0.001	-0.004	0.003	0.007	0.000	-0.0091	-0.0863	-0.0335	0.0024	-0.0128	0.0003	0.5102	0.0461	0.0009	-0.0115	0.0060	-0.0008
14	0.013	-0.003	-0.002	0.001	-0.000	0.003	-0.0060	0.0396	0.0087	0.0153	0.0024	-0.0122	0.0519	0.4531	-0.0010	-0.0173	0.0009	0.0006
15	-0.001	0.004	-0.000	-0.000	-0.001	0.001	0.0004	0.0279	0.0005	-0.0028	0.0073	0.0165	0.0082	-0.0083	0.0546	0.0045	-0.0030	0.0004
16	0.028	0.002	-0.016	0.004	-0.016	0.004	-0.0190	0.1231	0.0875	0.0406	-0.0040	0.0070	0.0963	0.185	-0.0040	-0.0608	0.0014	0.0014
17	-0.017	0.003	-0.001	0.007	-0.009	-0.003	-0.0063	0.0530	0.0249	0.0336	0.0013	0.0019	0.0338	-0.0044	-0.0018	0.0009	0.0911	-0.0006
18	0.008	-0.007	0.001	-0.001	0.006	-0.003	0.0126	-0.0353	-0.0393	0.0274	-0.0021	-0.0114	0.0479	-0.0314	-0.0026	0.0100	0.0070	-0.0083